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SHORT COMMUNICATION

The use of alfaxalone for premedication, induction and maintenance of anaesthesia in pigs: a pilot study

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Abstract

Objective The evaluation of alfaxalone as a premedication agent and intravenous anaesthetic in pigs.

Study design Prospective, clinical trial.

Animals Nine healthy, 6–8-week-old female Landrace pigs weighing 22.2 ± 1.0 kg, undergoing epidural catheter placement.

Methods All pigs were premedicated with 4 mg kg^{-1} alfaxalone, 40 μg kg^{-1} medetomidine and 0.4 mg kg^{-1} butorphanol administered in the cervical musculature. Sedation was subjectively scored by the same observer from 1 (no sedation) to 10 (profound sedation) prior to induction of anaesthesia with alfaxalone intravenously to effect. All pigs were maintained on alfaxalone infusions with the rate of administration adjusted to maintain appropriate anaesthetic depth. Quality of induction was scored from 1 (poor) to 3 (smooth) and basic cardiorespiratory variables were recorded every 5 minutes during anaesthesia. Results are reported as mean ± standard deviation or median (range) as appropriate.

Results Sedation scores were 9 (7–10). Inductions were smooth in all pigs and cardiovascular variables remained within normal limits for the duration of anaesthesia. The induction dose of alfaxalone was 0.9 (0.0–2.3) mg kg^{-1}. Three pigs did not require additional alfaxalone after premedication to facilitate intubation.

Conclusions and clinical relevance Intramuscular alfaxalone in combination with medetomidine and butorphanol produced moderate to deep sedation in pigs. Alfaxalone produced satisfactory induction and maintenance of anaesthesia with minimal cardiovascular side effects. Appropriate monitoring of pigs premedicated with this protocol is required as some pigs may become anaesthetized after intramuscular administration of this combination of drugs.

Keywords alfaxalone, pigs, premedication, swine, total intravenous anesthesia.

Introduction

Pigs are difficult to restrain physically as a result of their conformation and will often struggle vigorously, making intravenous (IV) or facemask administration of anaesthetic agents difficult to effect induction of anaesthesia. Sedation or induction of anaesthesia via the intramuscular (IM) route can be a useful alternative to these methods (Malavasi et al. 2015). Pigs have been sedated with various combinations of dissociative anaesthetics (ketamine), tranquilizers (such as azaperone) and α_2-agonists (such as medetomidine; Santos et al. 2016). Alfaxalone is a neuroactive steroid compound that enhances the action of the γ-aminobutyric acid-A receptor to induce general anaesthesia and muscle relaxation and has been administered both IV and IM in pigs (Keates 2003; Santos et al. 2016). Alfaxalone is not a scheduled drug in many countries and may offer a more convenient alternative to ketamine or opioids for anaesthesia in pigs.

The use of alfaxalone as a total IV anaesthesia (TIVA) protocol has not been, to the authors' knowledge, reported in pigs. The purpose of this pilot study was to investigate the quality of sedation using alfaxalone as part of a balanced premedication combination of drugs, and the quality of anaesthesia in pigs using an alfaxalone TIVA protocol.

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Materials and methods

The study protocol was approved by the University of Melbourne Animal Ethics Committee (Ethics Number 1312871.3). Twelve healthy, 6–8-week-old, female Landrace pigs weighing 22.2 ± 1.0 kg that were being anaesthetized for epidural catheter placement as part of another study were included. All animals were housed in the experimental facility for 7 days prior to the experiment to allow them to acclimatize to the environment. The pigs were fasted overnight before the day of the study and given access to water until the time of premedication. Pigs were deemed healthy and fit to enter the study based on physical examination prior to anaesthesia.

Twelve pigs were premedicated with an IM injection of 4 mg kg^{-1} alfaxalone (Alfaxan CD; Jurox Pty Ltd, Australia), 40 μg kg^{-1} medetomidine (Domitor; Zoetis, NSW, Australia) and 0.4 mg kg^{-1} butorphanol (Butomidor; Ausrichter Pty Ltd, Australia). All drugs were mixed in the same syringe and administered in the cervical muscles with an 18 gauge, 3.75 cm needle. Sedation was subjectively assessed by the same observer (SEB) 10 minutes after administration of drugs using a modified numerical scale from 1 to 10. As a guide, a score of 1 was considered to be no effect of premedication, 4 was considered mild sedation as animals were quieter than before premedication but still active, 7 was considered moderate sedation as animals were ataxic and reluctant to move and 10 was considered profound sedation as animals were laterally recumbent and minimally responsive to interaction. Approximately 10 minutes after premedication all pigs were moved from the housing pens to the procedure room where a 20 or 22 gauge catheter was placed in an auricular vein which was used for all further drug and fluid administration.

Pigs were preoxygenated via facemask for 5 minutes and general anaesthesia was induced using alfaxalone IV titrated slowly to effect (approximately 1 mg kg^{-1} $minute^{-1}$) until intubation was performed. Intubation was attempted once jaw tone was relaxed and it was possible to retract the tongue without resistance. If it were not possible to intubate, the jaw was released and an additional 0.5 mg kg^{-1} was administered before further attempts. The dose of alfaxalone required for intubation and time from premedication to induction were recorded. Quality of induction was scored based on a scale modified from previously published work (Covey-Crump & Murison 2008) using the following categories: 1) poor (marked tongue/jaw movement, swallowing, required additional alfaxalone and >1 attempt at intubation, significant excitement or movement); 2) fair (some tongue movement, slight cough, mild muscle twitching or paddling) and 3) smooth (no swallowing, coughing, tongue or jaw movement). All animals were connected to a circle breathing system to deliver 100% oxygen and allowed to breathe spontaneously. Hartmann's solution (Compound sodium lactate; Fresenius Kabi, Australia) 10 mL kg^{-1} $hour^{-1}$ IV was initiated. Anaesthesia was maintained with an alfaxalone infusion controlled by a syringe driver (Baxter Flo-Gard GSP Syringe Pump; Baxter Healthcare Pty Ltd, Australia) which was started at 0.2 mg kg^{-1} $minute^{-1}$ with the rate adjusted by 0.05 mg kg^{-1} $minute^{-1}$ based on assessment of anaesthetic depth. Criteria used to assess anaesthetic depth included eye position, degree of palpebral reflex, heart rate, respiratory rate (f_R) and spontaneous movement. An IV bolus of alfaxalone (10–20 mg) was administered if spontaneous movement occurred and the event was recorded. The alfaxalone infusion rate was recorded every 5 minutes and the total dose of alfaxalone given during anaesthesia was noted at the end of the procedure. heart rate, haemoglobin oxygen saturation, noninvasive blood pressure, electrogardiogram, f_R and end tidal carbon dioxide ($P_E'CO_2$) were monitored continuously (Small Animal Anesthesia Machine; SurgiVet CDS 2000, Smiths Medical PM Inc., WI, USA) and recorded every 5 minutes from the time of intubation until extubation. Hypotension was defined as mean arterial pressure < 60 mmHg, apnoea as cessation of spontaneous ventilation for more than 30 seconds and hypercapnia as $P_E'CO_2$ > 55 mmHg.

Once animals were stable under anaesthesia, they were positioned in left lateral recumbency and the skin in the lumbar spine region was aseptically prepared for placement of a lumbosacral epidural catheter. All pigs had 60 mg lidocaine (Ilium Lignocaine 20; Troy Laboratories, Australia) infiltrated subcutaneously at the site of catheterization. A 16 gauge, 8.9 cm Tuohy spinal needle was used to facilitate placement of an 18 gauge, 100 cm epidural catheter. Position of the spinal needle was confirmed by injection through the needle of 2 mL iohexol contrast (Omnipaque 240; GE Healthcare Pty Ltd, Australia) under fluoroscopy. A further 1 mL of iohexol was used to confirm correct position of the epidural catheter.

The alfaxalone infusion was stopped when epidural catheterisation was complete and the time from discontinuation of the infusion to extubation and the total duration and total dose of the infusion were recorded. Once extubated, all pigs were moved to a

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